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WHAT MAKES THE ILLITERATE LANGUAGE LEARNING GENIUS?

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1 Introduction

At the 2006 LESLLA conference in Richmond, Virginia, we presented some preliminary results of the data we collected on illiterate adult second language learners, focussing on the role of working memory in the more or less successful acquisition of second language (L2) and literacy skills in the LESLLA population (Kurvers & van de Craats, 2007). More specifically, we wanted to compare the adult data with those of primary school children and investigate whether the individual differences among adults in success at learning Dutch as a second language might be attributable to differences in working memory (WM) capacity. We had two good reasons for trying to find out more about this. First, the phonological loop, one of the main components of WM (see Juffs & Rodríguez, this volume) had been considered to be important in processing and analysing new verbal information. Therefore, WM capacity might be expected to influence L2 learning of low-educated adults as well as of children (Baddeley, 1999, 2003; Baddeley, Gathercole & Papagno 1998; Baddeley & Hitch, 1974; Ellis, 2001), and more specifically to play a role in the initial stages of reading in L2 (Baddeley & Gathercole, 1992; Carr Payne & Holzman, 1983; Goswami, Ziegler, Dalton, & Schneider; 2001). Secondly, we still did not know whether the working memory systems of low-educated second language and literacy learners are similar to those of educated literate second language learners and how their capacity can be measured (Juffs, 2006).

The results, however, not only pointed to a clear picture of differences in WM capacity of different groups of adult L2 learners compared to children and of the relationship between differences in WM capacity and differences in both second language and reading skills, but also to some intriguing but contradictory results that could not be explained by the data we had been analysing thus far. In short, we were left with some inconclusive results. Therefore, we wanted to dig further into the data to find out more about the participants who seemed to have done extremely well in learning Dutch as an L2 in comparison with other adults with similar backgrounds who did not seem to show much progress in L2 proficiency and literacy skills. If working memory capacity does not tell the whole story, then what constitutes the illiterate language learning genius?

In this contribution, we first summarize the main outcomes of the previous study (Section 2), and then look for candidate predictors of the illiterate language learning genius by a comparison of two groups of participants matched on background variables (Section 3) and we take a closer look at some individuals who did very well or very badly in L2 learning (Section 4). Section 5 closes with discussion and conclusions.

2 Memory, Second Language Reading, and Vocabulary: A Summary

This section presents a brief summary of the study that was described extensively elsewhere (Kurvers & van de Craats, 2007), to give the necessary background for the new data and analyses in Section 3.

2.1 Design of the study

The participants in our study were 57 adult L2 learners, learning Dutch in adult education centres, between 18 and 61 years old, without any elementary schooling in

their home country (seven male, 50 female, 36 from Morocco, seven from Turkey and 17 from a variety of other language backgrounds), and 116 primary school children (44 Turkish, 34 Moroccan and 38 from a variety of minority groups) ranging from 4 to 12 years old. The children were divided according to their grade in (pre)school, the adults according to their literacy level in combination with their general proficiency level as defined by the Common European Framework of Reference for Languages (CEF) (Council of Europe, 2001). As for the adults, 25 had reached Level A, a very basic level of literacy, and an L2 proficiency level below A1 (the lowest level of CEF), 13 had reached Level B for literacy, but an L2 proficiency level below A1, eleven had reached Level C in literacy and only eight adults had reached level A2.[1] For this study, two types of span tests were used: a digit span task (viz. the subtest of the WISC-R), and a non-word repetition task. The non-word repetition task (NRT) used here was developed by Gerrits (De Bree, Wilsenach & Gerrits, 2004), based on Dollaghan & Campbell (1998). The stimuli were 24 pseudo-words, ranging in syllable length from two (*keefuus*) to six (*peetaaneisookoonief*). These words did not contain any consonant clusters. The standard score of the NRT is the percentage of correctly pronounced phonemes. Because it is well known that adults have serious problems in acquiring native-like phonological skills, we doubted whether this measure would be adequate for assessing their WM capacity. Therefore, we calculated another score as well (NRT span score), more comparable to the digit span score (i.e., how many syllables could be repeated correctly). For this last measure, small deviations in the pronunciation of phonemes were disregarded, e.g. *keefienuu* pronounced as *keefienoe* was accepted as a correct repetition of a three-syllable word (as this is a well-known pronunciation error for many learners of Dutch).

In order to look for evidence of a potential relationship between WM capacity and L2 vocabulary learning on the one hand and learning to read on the other, an L2 vocabulary test and a word reading task for decoding fluency were administered. To assess receptive vocabulary, a subtest of the TAK ('Language Test for All Children', Verhoeven & Vermeer, 2002) was used. This subtest takes the form of a picture selection task and consists of four pictures on each page. The participant is asked to point to the correct picture when asked questions (e.g., where is the bike? where do you see reading?). The lexical items are all frequent Dutch words and belong to the domain of daily life and thus are of relevance to adults as well. As a word reading task, the first card of the DMT (Three Minute Test) was used. Items on the first card are monosyllabic words without consonant clusters. (For more details, see Kurvers & van de Craats, 2007.) The reading score is the number of correctly read words. Small and frequent deviations in the pronunciation of typical Dutch vowels were not counted as reading errors.

2.2 Results

For all participants, the intercorrelations between the three measures of WM were high and significant ($p<.01$). The highest correlation was between the two NRT scores, the next highest between the digit span score and the percentage of correct phonemes on the NRT and the lowest between the two span scores. This pattern was common for children and adults. These results are comparable to those reported in Gathercole & Baddeley (1991) and Papagno & Vallar (1995:104) who suggest that both measures tap the same underlying construct, namely phonological working memory, unlike Snowling, Chiat & Hulme (1991), who claim that a non-word repetition task measures both WM capacity and phonological processing, and De Bree *et al.* (2004), who found that a low score on the NRT phoneme score did not predict a low score on the digit span task (in a population with a risk of dyslexia).

[1] See also Appendix 1 for a schematic overview of the proficiency levels for literacy and second language of the Common European Framework of Reference for Languages.

All WM scores were higher for the children than for the adults, although the difference was only significant for the digit span scores (t=2.71, p<.01), but not for the two NRT scores, probably because children work intensively with the Dutch digits on daily basis, whereas illiterate adults do not.

However, when we compared the WM scores of the adults at several L2 levels, and when we related WM score to vocabulary size, we came up with results that at first seemed to contradict each other, as can be seen from Tables 1 and 2.

Table 1: Group scores for below or above A1 proficiency level in L2.

	Groups	N	Mean	SD	T-value
Forward DST	Below A1	38	3.32	1.16	-2.74**
	A1 / A2	19	4.40	1.52	
NRT phoneme score	Below A1	38	80.71	9.73	-3.08**
(% correct phonemes)	A1 / A2	19	88.22	6.60	
NRT span score	Below A1	38	9.03	3.84	-4.80**
	A1 / A2	19	14.58	4.58	
Vocabulary	Below A1	38	19.03	14.31	-4.72**
	A1 / A2	19	48.58	15.65	
Word Reading	Below A1	38	18.67	13.91	-4.16**
	A1 / A2	19	35.95	13.02	

** p<0.01 * p<0.05

As can be inferred from Table 1, the two groups differ significantly on all working memory scores, with the above average students outperforming the average students. In fact, this information contradicts the absence of correlations with vocabulary size in Table 2, since here the higher WM scores go together with higher proficiency levels in Dutch. The two groups also differed significantly in L2 vocabulary size and L2 word reading level, with the A1/A2 group having much higher scores on both measures.

This seemed to indicate positive correlations between WM scores and L2 vocabulary, comparable to what was found in studies with children. Table 2 presents the results.

Table 2: Correlations between WM-scores and estimated vocabulary size

		Estimated vocabulary size
Children (N=116)	Forward DST	.570**
	% of correct phonemes NRT	.349**
	NRT span score	.363**
Adults (N=57)	Forward DST	.085
	% of correct phonemes NRT	.041
	NRT span score	.195

** p< .01 * p<.05

As shown in Table 2, for the children, all WM correlations with vocabulary are positive and significant, although not very high for the non-word repetition scores. However, when we focused on the adult learners in our sample, none of the working memory measures in Table 2 correlated significantly with L2 vocabulary size. Quite the contrary: two of the correlations are close to zero. For the L2 word reading scores of the adults, two of the WM scores did not correlate significantly (digit span and % correct phonemes), while only the NRT-span score correlated significantly with the L2 reading score (r=.395, p<.05).

We had to conclude that although the higher level L2 groups had significantly higher WM scores and also significantly higher scores on both L2 vocabulary and L2 word reading scores, the correlations between WM scores and L2 vocabulary and

reading scores were low in most cases and not significant (for more details, see Kurvers & van de Craats, 2007).

To determine the source of these contradictory results, we began by taking a closer look at the groups that consisted of L2 learners who differed – also within groups – in many respects, such as years of residence, months of L2 lessons, age, country of origin, contact with native Dutch speakers and number of children. We then selected pairs of L2 learners who clearly differed in proficiency level of Dutch, but not in background variables.

3 Comparison of matched groups

We started again with the two groups of adults as described in Section 1. The first group had literacy levels A or B and an L2 proficiency level below A1 in terms of the Common European Framework (Council of Europe, 2001) and a second group of individuals had a proficiency level above average (C/A1 or A2). See Appendix I.

From this group of individuals, we formed pairs of individuals, one from each group (below average and above average), who were matched on the following variables:

- months of L2 instruction
- age
- years of residence in the Netherlands
- having children[2]
- native language.

We used the variables in this order, starting with individuals in both groups that had had the same amount of L2 instruction time, were roughly of the same age, had been in the Netherlands for about the same number of years, had both either children of primary school age or no children, and had the same language background. None of these subjects had received any education in the country of origin.

Adopting this procedure, we were able to form 12 pairs with similar backgrounds but different levels of L2 proficiency. Table 3 presents the main background variables of the two groups. As can be seen in Table 3, the two matched groups do not differ regarding length of residence in the Netherlands, age and average period of having attended L2 lessons. Eight of the subjects came from Morocco and 16 from various countries such as Somalia or Afghanistan. In eight pairs, both participants had children, in two pairs neither participant had children, and two pairs were mixed in this respect.

Table 3: Background data of the matched groups: duration of L2 lessons, age and length of residence.

	Group	N	Mean	sd	T
Duration of L2 lessons†	Average	12	3.08	1.16	-0.37
	Above Average	12	3.25	1.05	
Age	Average	12	36.08	12.05	0.51
	Above Average	12	33.75	10.57	
Length of residence	Average	12	9.08	8.27	0.12
	Above Average	12	8.71	6.82	

†=Scale from 1 to 5 (<6 months, 6-12 months, 1-2 years, 2-5 years, >5 years)

For this group of 24 individuals, the intercorrelations (Pearson) between the three WM measures were .37 for digit span and NRT phoneme score, .26 for digit span and NRT span score and .62 for NRT phoneme score and NRT span score. Only the last correlation was significant ($p<0.01$). Table 4 presents the differences between the two groups for the WM measures and the scores on L2 vocabulary and word reading.

[2] Having young children attending school is considered a variable that guarantees (much) contact with the target language.

Table 4: Scores of the matched pairs groups on WM measures, L2 vocabulary and L2 reading

	Group	N	Mean	Sd	T	Cohen's D
Digit span	Average	12	4.08	1.16	-0.97	0.40
	Above Average	12	4.67	1.73		
NRT phoneme	Average	12	86.07	3.94	-1.54	0.63
	Above Average	12	89.54	6.74		
NRT span score	Average	12	11.00	5.00	-2.06*	0.73
	Above Average	12	14.83	5.49		
Vocabulary	Average	12	30.58	14.69	-2.63*	1.07
	Above Average	12	47.33	16.48		
Word Reading	Average	12	17.80	12.09	-2.89**	1.23
	Above Average	12	32.92	12.49		
L2 level	Average	12	1.50	0.52	-9.05**	3.69
	Above Average	12	3.42	0.52		

*p<0.05, **p<0.01

The difference in level of L2 proficiency (T=9.95, p<0.01) between the two groups was the selection criterion but it is striking that the average proficiency level of the first group is about two levels lower (on a five point scale) than that of the above average group. On all WM measures, the scores of the above average group are higher, but the difference only reaches significance for the NRT-span score (the number of syllables that can be correctly repeated). Because the t-values are calculated for small group numbers, the effect sizes (Cohen's D) might be more telling here. Except for the forward digit span with a medium effect-size (0.40), the effect sizes are high for the two non-word repetition scores and also for L2 vocabulary and L2 word-reading scores. In short, the two groups do not only differ substantially in WM measures, but also in L2 vocabulary and L2 word reading.

Table 5 presents the correlations between WM measures, vocabulary and word reading for this group of 24 participants.

Table 5: Correlations between WM measures, L2 vocabulary and L2 reading scores

	L2 Vocabulary	L2 Reading
Forward DST	-0.097	0.115
% correct phonemes NRT	-0.073	0.427*
NRT span score	0.155	0.478*

* p<0.05

None of the correlations between WM measures and L2 vocabulary are significant: The correlations are low and even negative for two of the three measures. Both measures of the non-word repetition test, however, reveal positive and significant correlations with the scores on the word reading test. These correlations are, in fact, relatively high compared to many of the correlations that have been presented in the literature (Juffs, 2006). For these 24 participants, WM capacity does not seem be a good predictor of success in L2 learning.

Before discussing these outcomes in more detail, we present some characteristics of the three most and the three least successful learners of Dutch as L2, who seemed to have fossilized or are fossilizing at a low L2 proficiency level.

4 WM Scores and Learner Characteristics

The group of most successful learners who attained proficiency level A1 or A2 for all four language skills - listening, speaking, reading and writing - were characterized as 'above average.' That characterization is, in fact, an understatement because it took considerable trouble to find immigrants meeting these criteria. We phoned, sent e-mails to teachers and adult education centres and put out a call for participants on several websites to second language teachers all over the country and finally found eight people meeting the criteria of level A2 and 11 of level A1. It might be the case that we missed half of the potential number of L2 literacy students who had reached this level, but even then we have to conclude that truly successful L2 learners who started as fully illiterates are really quite rare. Therefore, the question as to what the learner characteristics of these few learners are is an intriguing one. In Table 6 the scores of the three best learners are presented, ordered with respect to vocabulary scores, and in Table 7 the scores of the three best learners are presented, ordered with respect to reading scores.

Table 6: Scores on language and WM tests of the three best learners ordered with respect to the vocabulary test score

Code of participant	Vocabulary score	Reading score	Digit span	NRT phoneme score	NRT span score	L2 proficiency level
#59	77	43	5	95	21	A2
#56	71	40	4	89	16	A2
#60	68	32	2	77	8	A1

As can be seen in Table 6, learner 59 has the highest scores on the NRT phoneme score and the NRT span score, but not on the digit span score (highest score is 8). The WM scores of learner 56 are lower and the WM scores of learner 60 are extremely low. So it is only for the best learner that there seems to be a relationship between NRT scores and vocabulary size.

Table 7: Scores on language and WM tests of the three best learners ordered with respect to reading

Code of participant	Vocabulary score	Reading score	Digit span	NRT phoneme score	NRT span score	L2 proficiency level
#51	55	53	7	94	19	A2
#53	49	47	4	89	16	A2
#55	35	46	3	95	19	A2

The best readers, shown in Table 7, all have good WM scores but not the highest, except for learner 55, who has the best NRT phoneme score (together with learner 59 in Table 6). The correlation found between NRT score and reading score is reflected in the results of the three learners above.

In the same way we can consider the results of the least successful learners of the paired groups. In Table 8, the scores of the least successful learners are ordered with respect to vocabulary scores and in Table 9 with respect to reading scores.

Table 8: Scores on language and WM tests of the three least successful learners ordered with respect to the vocabulary test scores

Code of participant	Vocabulary score	Reading score	Digit span	NRT phoneme score	NRT span score	L2 proficiency level
#31	12	0	5	90	13	Literacy A
#04	13	-	5	87	12	Literacy A
#39	21	20	4	84	10	Literacy A

Table 8 shows that the digit span scores are similar to those of the best learners in Table 6 and that also the phoneme scores of these learners are not extremely poor.

Table 9: Scores on language and WM tests of the three least successful learners ordered with respect to the reading test scores

Code of participant	Vocabulary score	Reading score	Digit span	NRT phoneme score	NRT span score	L2 proficiency level
#31	12	0	5	90	13	Literacy A
#36	59	7	2	79	6	Literacy A
#17	57	9	2	82	10	Literacy B

Most striking in Table 9 is that a low reading score can go together with a fairly good score for vocabulary. Learners 36 and 17 seem to belong to the type of illiterate learners who can learn the spoken language but for whom learning to read and write is perhaps too high a target.

One might expect that the best learners are young, have much language contact, are motivated learners, have much support from home, attend intensive courses and can learn under favourable social and economic circumstances (SES), but this expectation is not confirmed, as the overview in Table 10 shows.

Table 10: Overview of characteristics of the six best learners

	Residence	Age	L2 lessons	Fem/ male	Language contact	Motivation/ home support	SES favorable
#59	20 yrs.	44	5th yr.	Fem.	Much	High/no	no
#56	8 yrs.	29	4th yr.	Fem.	Little	Normal/yes	yes
#60	23 yrs.	60	1st yr.	Fem.	Much	Normal/yes	yes
#51	5 yrs.	23	3rd yr.	Fem.	Much	High/yes	yes
#53	8 yrs.	28	4th yr.	Fem.	Much	High/no	no
#55	6 yrs.	28	2nd yr.	Male	Little	Very high/no	yes

The data shown in Table 10 suggest that length of residence, age, duration of the L2 lessons, language use and language contact do not seem to be contributing factors either: there is not a single background factor that accounts for all successful L2 learners. Not all successful learners are young, have attended L2 lessons for a long period or have much language contact. An older learner like #60 is a successful learner, but only has been attending L2 lessons for a year; in this case it is more likely that her high vocabulary score is more due to her long stay in Netherlands than to the number of L2 lessons that she attended.

Table 11 shows the same characteristics for the least successful learners. The learner who is least successful in vocabulary (#31) is also least successful in reading.

Table 11: Overview of characteristics of the five least successful learners

	Residence	Age	L2 lessons	Female/male
#31	10 yrs.	49	2nd y.	Female
#04	25 yrs.	56	1st y.	Female
#39	15 yrs.	52	1st y.	Female
#36	7 yrs.	34	5th y.	Female
#17	25 yrs.	49	5th y.	Female

The same as was concluded for the successful L2 learners can essentially be concluded about the impact of background variables for the least successful L2 learners. Not all are old, have not attended L2 lessons for a short period, or have been in the Netherlands for roughly the same length of time. When comparing Tables 6 through 11 for the most successful and the least successful learners, it can be concluded that the best results for reading are found for relatively young learners between ages 20 and 30, that the success in reading does not necessarily entail a large vocabulary and that higher NRT span scores are involved, although some of the least successful learners also have high digit and phoneme scores. The best learners have obtained these results within two to four years of L2 lessons and after five to eight years' of residence in the Netherlands. The least successful learners on average are older and have been resident in the Netherlands for much longer time (seven to 25 years). A longer stay seems to be negatively correlated with good results.

5 Conclusions and Discussion

Returning to the literature on WM and its relationship with vocabulary learning and learning to read and write, we note that we found significant differences between the two matched groups for NRT span score, vocabulary size and reading (and of course L2 proficiency level). We found significant correlations between the NRT phoneme score and reading ($p<.05$), the NRT span score and reading ($p<.05$) and length of time spent on L2 lessons and vocabulary ($p<.05$), but not between WM measures and L2 vocabulary. Again these data do not support the idea that for illiterates varying levels of success in learning a second language are attributable to differences in working memory (cf. Juffs, 2006).

Given the high and positive correlations of the two NRT scores with word reading, it might be that the ability to learn to read and write – for which WM capacity does seem to be predictive – might operate as a mediating factor, i.e. for illiterates, working memory affects the ease with which the subjects learn to read and write in an alphabetic writing system, which in turn might influence and speed up the acquisition of L2 vocabulary learning. In that case it makes sense to conclude that it does not seem wise to omit L2 reading from lessons for illiterates and focus only on oral skills (as is sometimes suggested). Or are we viewing this backwards? It could also be that some hidden factor affects the ease with which some subjects learn to read and write in Dutch as a second language, which in turn has a positive effect on WM capacity. In other words, the direction of causality is not clear. What came first, a larger non-word span and the ability to recall series of phonemes prior to learning to read and write or a larger span which is the result of learning to read and write? In order to provide a clear and convincing answer further research is needed.

Coming back to the question as to what makes the illiterate language learning genius, we can only say that it is not one specific factor such as length of residence, WM capacity, contact with the target language or age. Rather, it is a complex of factors. The most striking finding of this study seems to be that for each individual LESLLA learner this complex differs. Fine-grained research and analyses of what this complex will be key in future research that goes beyond the assumption that a single factor is responsible.

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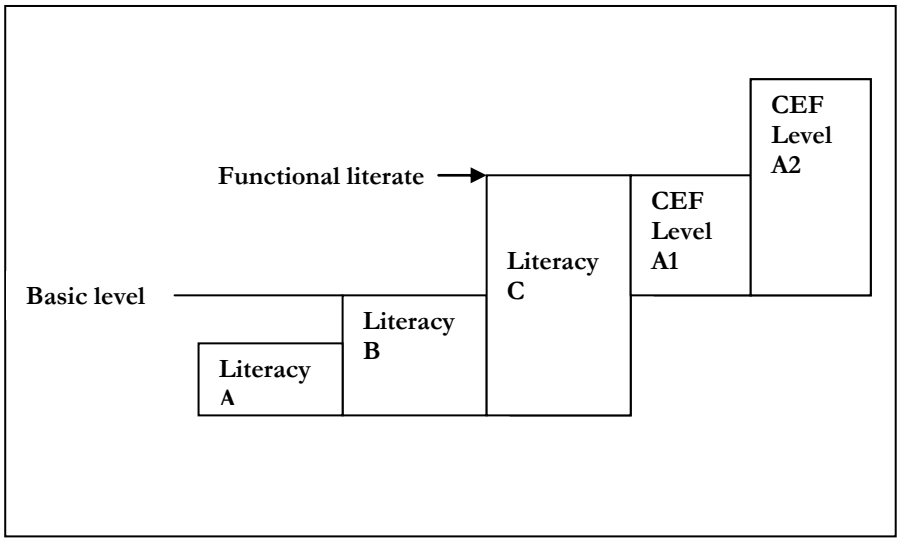
Appendix 1: *Literacy and L2 Levels in CEF (Common European Framework) format*



Appendix 2: *Back ground data pairs*

Paar	Nummer	Age in years	Years of residence	Period of L2 lessons**	Any children?
1	1*	26	4	2-5 years	yes
	2	23	5	2-5 years	yes
2	1	34	7	2-5 years	yes
	2	29	8	2-5 years	yes
3	1	56	25	<6 months	yes
	2	61	23	6-12 months	no
4	1	49	10	12-24 months	yes
	2	35	9	6-12 months	yes
5	1	30	1	6-12 months	no
	2	31	1	6-12 months	no
6	1	26	4	12-24 months	yes
	2	33	3	12-24 months	yes
7	1	24	5	<6 months	yes
	2	23	6	6-12 months	no
8	1	32	4	12-24 months	yes
	2	28	6	12-24 months	no
9	1	33	6	2-5 years	yes
	2	28	8	2-5 years	yes
10	1	22	3	2-5 years	no
	2	30	3	2-5 years	no
11	1	52	15	2-5 years	yes
	2	40	13	2-5 years	yes
12	1	49	25	2-5 years	yes
	2	44	20	5-6 years	yes

* 1 refers to the subject of the average group, 2 to the above average group
** Categories: less than 6 months, 6-12 months, 12-24 months, 2-5 years, more than 5 years.

Appendix 3: *Pair-wise comparisons scores*

Pair	Subject	Vocabulary score	Forward DST	Percentage correct phonemes NRT	Score NRT	L2 level
1	1*	22	4	90,10	13	2
	2*	55	7	94,80	19	4
2	1	59	2	79,17	6	1
	2	71	4	89,58	16	4
3	1	13	5	87,50	12	1
	2	68	4	77,08	8	3
4	1	12	5	90,10	13	1
	2	33	5	90,63	18	3
5	1	34	4	85,42	12	2
	2	38	8	93,75	19	3
6	1	31	5	92,19	16	2
	2	35	3	90,10	9	3
7	1	25	4	85,94	11	1
	2	30	2	90,10	17	3
8	1	32	4	86,46	13	2
	2	35	3	95,83	19	4
9	1	29	6	88,02	10	1
	2	49	4	89,58	16	4
10	1	32	4	80,21	6	2
	2	40	5	75,00	13	3
11	1	21	4	84,90	10	1
	2	37	6	92,19	3	3
12	1	57	2	82,81	10	2
	2	77	5	95,83	21	4

* 1 refers to the subject of the average group, 2 to the above average group