Contrastive vs Non-Contrastive Meta-Phonetic Input in Teaching Foreign Language Pronunciation

Apport de l'enseignement métaphonétique contrastif ou non contrastif dans l'enseignement de la prononciation des langues étrangères

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1. Introduction

1   Although the myth of the native speaker as an ideal foreign language speaker has already been deconstructed (Benke & Medgyes, 2005; Moussu, 2006), their pronunciation is often perceived as a model in foreign language communication by non-native speakers and applied as a reference standard in related research. What is more, native speakers are the evaluators of non-native speakers pronunciation in most studies on foreign accent (e.g. Anderson-Hsieh, Johnson & Koehler, 1992; Carmichael, 2000; Flege, 1988; Flege & Hillenbrandt, 1984; Munro & Derwing, 2001; Sheppard, Hayashi & Ohmori, 2007). The same was true in foreign language teaching methodology, where learners' errors used to be considered in a negative light, and foreign language sounds were evaluated either as correctly or incorrectly produced. Today, the communicative value of foreign language pronunciation is emphasized and the terms "deviation" or "approximation" are regarded as more adequate than "error".

2   According to interlanguage theory, foreign language (L2) learning is a process of autonomous code formation that gradually approximates to the L2 quality (Peltola, Rautaoja, Alku & Peltola, 2017). Despite the upper-limit theory of approximation to foreign language pronunciation (Flege & Hillenbrandt, 1984), several researchers (e.g. Dickerson, 1974) posit the continuous improvement of non-native speakers' pronunciation. For Dickerson (1974), the first elements to be eliminated in this process are the most obvious pronunciation deviations, while closer approximations are typically more persistent. On the other hand, according to Weinreich's (1953) concept

of language interference, approximation is significantly aided by interlingual identification of elements. Several longitudinal experiments (e.g. Meador, Flege & MacKay, 2000), have shown that the most obvious deviations in foreign language pronunciation were eliminated after phonetic training, while closer (yet phonetically still imprecise) approximations of L2 sounds tended to persist. Minor deviations have more significant persistence, although they have less impact on speech comprehensibility (Kralova, 2016).

3   In learning foreign language pronunciation, learners have to acquire and automatize a complex set of articulatory gestures or modify the existing articulatory models, with each individual using their own strategies. A high level of automatization of L2 pronunciation is necessary for effective and economical oral communication. When teaching an L2, it is important to realize that auditory-articulatory engrams are not innate and that the only way of creating or storing new memory engrams (both receptive and productive) in the human brain is repeated reception and production (Malikova, 1993). As learners become aware of the differences between their own output and an authentic output in the L2, they may attempt to modify their articulation strategy.

4   The training of phonematic hearing and modification of a learner's foreign language perception base are important steps that should precede the practice of articulation (Chebenova, 2001). Following the principles of language ontogenesis and phylogenesis, the receptive phase of training should be followed by the productive phase aimed at drill, fixation and automatization of articulatory gestures and the creation of dynamic articulatory stereotypes. At the same time, it is useful for adult learners to be aware of the differences between phonetic-phonological norms of the native and the foreign languages (Cummins, 2005). For them, conscious practice is more effective than intuitive-imitative practice, and several studies (e.g. Kralova, 2011) confirm the benefits of practical phonetic training combined with adequate theoretical information.

5   Nonetheless, there is some disagreement about the extent to which it is necessary for learners to have meta-linguistic knowledge of the given system. Some authors (e.g. Peltola, Rautaoja, Alku & Peltola, 2017) assume that the automatic processing of language phenomena does not require it, while others (e.g. Carmichael, 2000) suggest that meta-linguistic context has a facilitative effect with adult learners of a foreign language. This is partially due to the fact that the conceptual-abstract memory develops intensively with age. Therefore, the process of acquiring new habits and skills in adult learners should include adequate theoretical information. When learners are cognitively mature for explicit teaching, it can significantly accelerate the whole process of learning (Wrembel, 2005), as new temporary links from the kinaesthetic analyser (Kralova, 2011) created by the learner's own activity become subsequently connected to the theoretical system.

6   Not many studies on the effectiveness of explicit phonetic-phonological instructions (meta-phonetic input) in L2 pronunciation learning have been undertaken so far, but almost all of them confirmed their positive correlation (e.g. Derwing & Munro, 2005; Kissling, 2013). However, the existing literature does not provide any experimental comparison of the effectiveness of contrastive meta-phonetic input (comparing L1 and L2 phonic systems) with the effectiveness of *non*-contrastive input (dealing solely with the L2 phonic system).We believe that the comparative analysis of native and foreign language phonic systems (focusing on potential interference phenomena) might be

beneficial to adults when learning foreign language pronunciation, because the identification of identity is a guiding principle in foreign language learning (Kralova, 2011).

7   Flege, Bohn and Jang (1997) state that cross-linguistic phonetic interference is obvious mainly with vowels and other authors join them to claim that the production of consonants plays a much less significant role in a foreign accent (e.g. Mildner & Horga, 1999). Kralova's (2011) findings confirm both claims. Moreover, several studies have found that the correct position of vowels in the L2 formant scheme highly positively correlates with an overall level of L2 phonic competence (e.g. Mildner & Horga, 1999; Munro, Derwing & Flege, 1999). Therefore, given that vowels are relatively more variant, some (e.g. Bohn & Munro, 2007) argue that vocalic mistakes have a more significant influence on speech comprehension than consonantal mistakes.

2. Methods

2.1. Objectives

8   The primary objective of the study was to compare the extent of qualitative approximation of English short vowels produced by Slovak learners after ten-weeks of meta-phonetic input (theoretical information on the phonic system of a language). The input focused on Slovak-English contrastive phonetics (Kralova, 2011) in the experimental group (E_A) and solely on the English phonic system (Roach, 2009) in the control group (K_A). Together with the contrastive and non-contrastive meta-phonetic input (45 minutes a week) both groups received identical pronunciation training aimed at the segmental subsystem of the English language (45 minutes a week).

2.2. Participants

9   Eighty EFL university students (60 females, 20 males) participated in the experiment. Their average age was 19 years and their native language (L1) was Slovak. Their English grammatical and lexical competence was at B1-B2 level (Allan, 2005). Most of them started learning English at primary school with a non-native teacher of English and had never stayed in an English-speaking country for any length of time. Two quasi-homogeneous groups were created by random sampling on the principle of availability: the experimental group (40 participants) and the control group (40 participants).

2.3. Material

10 The primary research material was the audiorecording of participants' extemporaneous English speech (average length: 3.8 minutes) in the pre-test and in the post-test (after ten weeks) conditions. The topic of their utterances was autobiographical in order to preserve similar vocabulary and style.

2.4. Data Analysis

11 The recordings were experimentally analysed in the phonetic laboratory in the Speech Analyser system (version 2.7) which displays the oscillogram, broadband sonogram and

LPC spectrum (Figure 1). Seven short English vowels /ɪ/, /e/, /æ/, /ʌ/, /ɒ/, /ʊ/, /ə/ were segmented from each recording both in the pre-test and the post-test. The location of the most significant change in amplitude, frequency and shape of the acoustic wave on the oscillogram was determined and the corresponding vowel was manually segmented on the basis of audio-correlational and visual-correlational methods.

12   Then, the spectral analysis of the vowel was done and the first (F_1) and the second formant (F_2) of the vowel was read from the LPC spectrum. The average F_1 and F_2 values for every vowel were calculated from five different measurements due to high individual and contextual variation of formants. The formant values of the vowels produced by five British English native speakers (A) were used as reference values for the approximation analysis. The standard F_1 and F_2 values of English short vowels (A^0) (Gimson, 1989) and the standard F_1 and F_2 values of corresponding Slovak short vowels (S^0) (Kral & Sabol, 1989) stated in relevant phonetic publications were used as the basis for comparison to balance the potential variance of native speakers production.

13   Statistical analyses were carried out using the OpenStat program to identify the relationship between the variables: the experimental analysis of pronunciation (dependent variable) and the contrastive meta-phonetic input (independent variable). The inter-group differences between the pronounced and the referential formant values were analysed in the pre-test and the post-test.

Figure 1. – Experimental analysis.
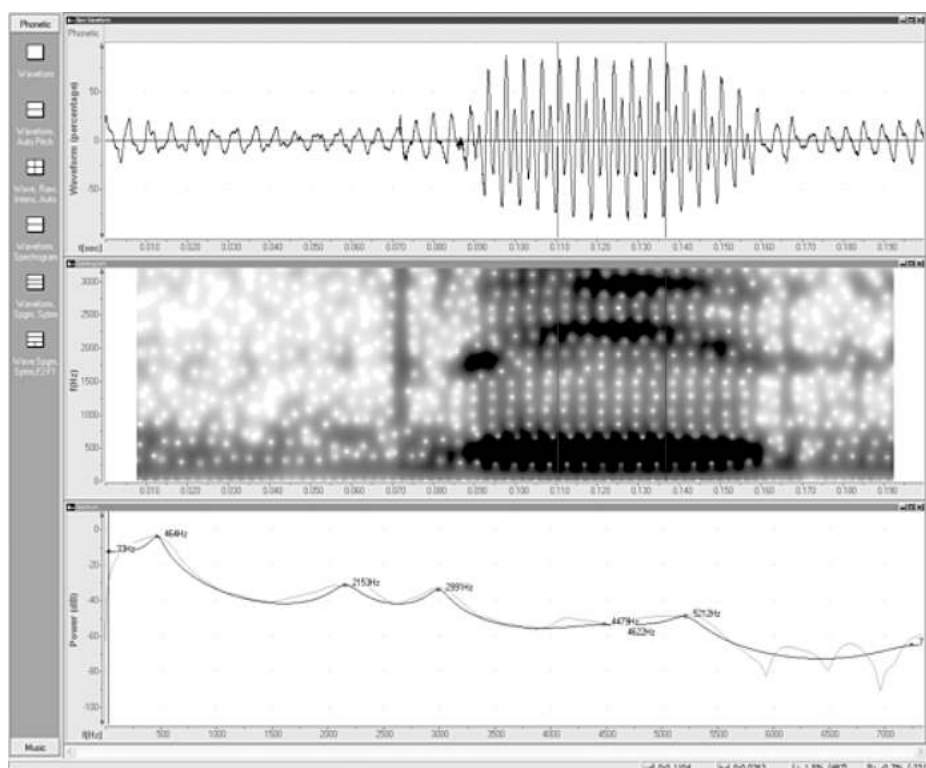
2.5. Hypotheses

14   The following hypotheses were formulated:

1. English short vowels produced by the participants in the post-test will approximate to the referential values more than the vowels produced in the pre-test.

2. English short vowels produced by the experimental group in the post-test will approximate to the referential values more than vowels produced by the control group in the post-test.

3. Results

15   Table 1 contains the F_1 and F_2 values of vowels produced by the experimental group (E^1_A) and the control group (K^1_A) in the pre-test and by the experimental group (E^2_A) and the control group (K^2_A) in the post-test, the English and Slovak standard formant values (A^0, S^0) and the reference formant values of vowels produced by British English native speakers (A). The variance for individual formants is in most cases lower than 50%, with the exception of F_2 [ə] values in the E^1_A group (V_x = 55%).

Table 1. − F_1 and F_2 mean values.

Group	/ɪ/		/e/		/æ/		/ʌ/		/ɒ/		/ʊ/		/ə/	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
S^0	285	1916	452	1718	700	1510	682	1315	481	1084	326	967		
A^0	360	2220	600	2060	800	1760	760	1320	560	920	380	940	560	1480
A	351	2114	699	2021	771	1700	758	1367	600	970	394	980	525	1479
E^1_A	315	1914	499	1818	630	1571	642	1352	491	1116	386	955	492	1854
E^2_A	353	2110	644	1966	682	1689	708	1396	542	1091	385	996	519	1546
K^1_A	321	1909	473	1801	694	1568	656	1348	482	1099	380	962	486	1866
K^2_A	342	2050	569	1927	744	1689	704	1383	525	1067	395	1002	508	1653

16   The formant scheme (Figure 2) illustrates a high degree of proximity between the standard formant values (A^0) and the reference formant values produced by the five British English native speakers (A), as well as their distance from the standard formant values of Slovak vowels (S^0).

Figure 2. − F$_1$ and F$_2$ reference and standard values.
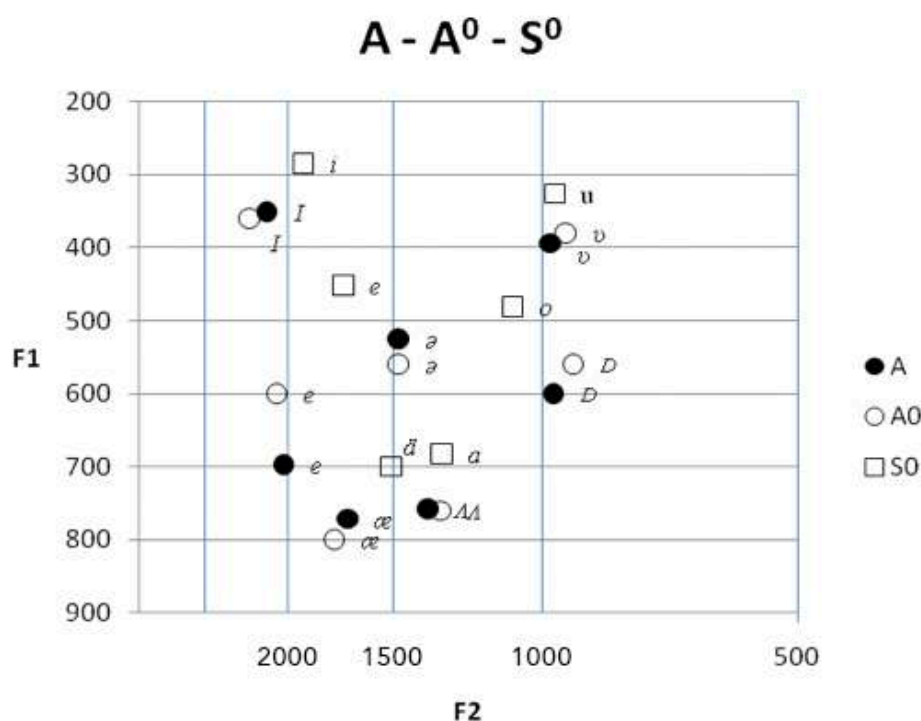
17   The formant scheme (Figure 3) comparing the English formant values produced by the participants in both the experimental and control groups in the pre-test (E^1_A and K^1_A) shows their significant deviation from the reference values (A). The formant values are in the positions closer to the Slovak vowels than to the English vowels (cf. Figure 2). On the contrary, the formant scheme (Figure 4) showing the relationship of formant values produced by the participants in both groups in the post-test (E^2_A and K^2_A) indicates closer approximation of formant values to the English reference values (A) and increased distance from the Slovak values (S^0) (cf. Figure 2). It is thus possible to confirm more significant approximation of formant values in the post-test in comparison with the pre-test.

Figure 3. – F_1 and F_2 referential and produced values (pre-test).
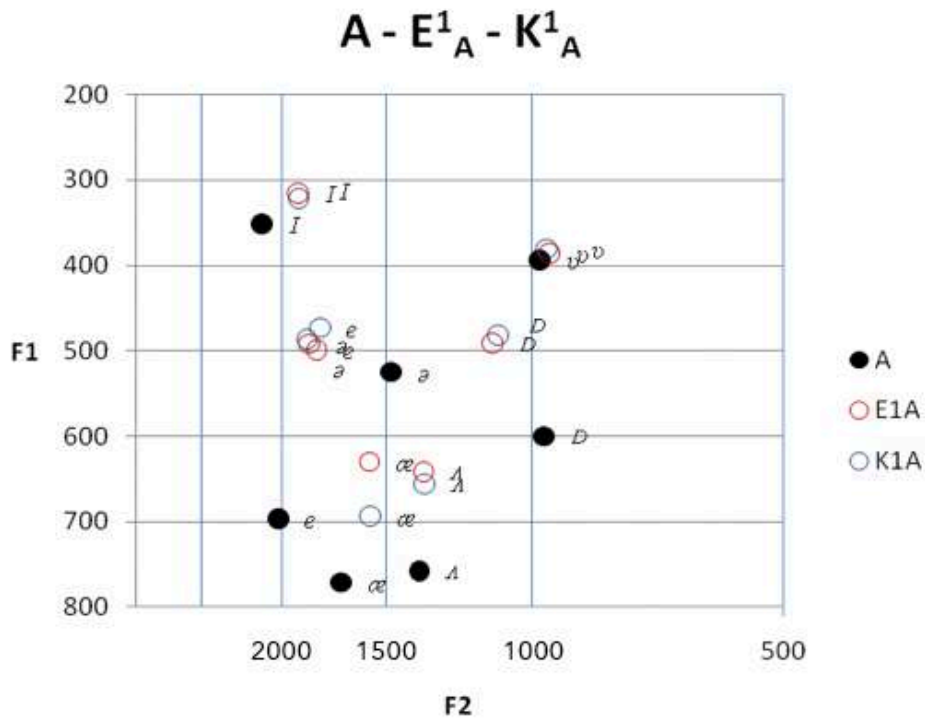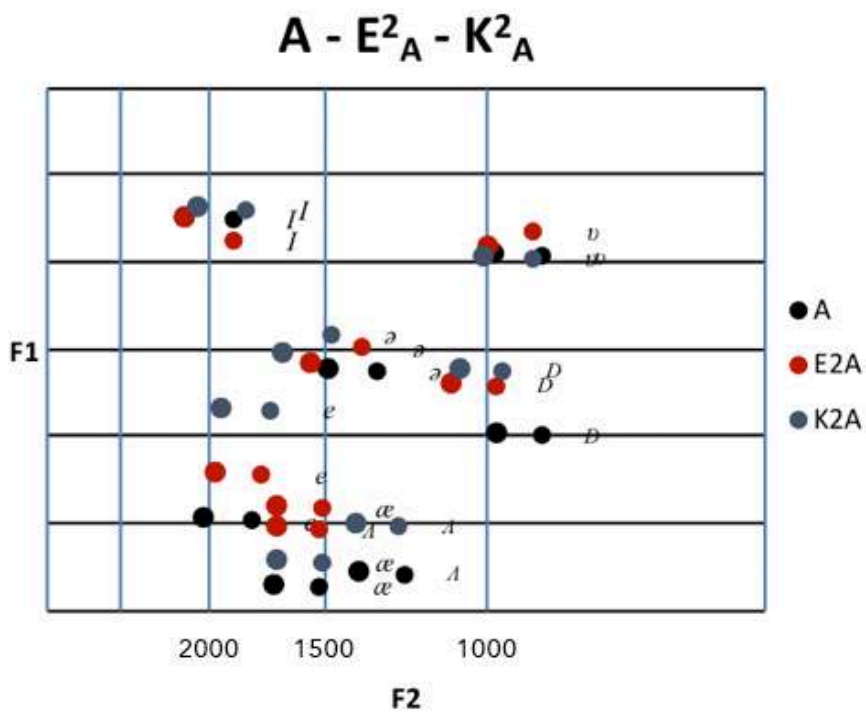

Figure 4. – F_1 and F_2 referential and produced values (post-test).

18   The difference of formant values of the vowels produced by the participants and the reference values were calculated. The degree of approximation not the direction of approximation (positive or negative) was relevant, therefore all values were treated as

positive. An overall difference of formant values for each participant and an overall difference of formant values within both groups (in the pre-test and the post-test) were calculated (Table 2).

19 The average difference of the produced and the reference values was higher in the pre-test (i.e. the average approximation to the reference values was lower) than in the post-test. The average difference in the post-test was significantly lower (i.e. the approximation was higher) in the experimental group than in the control group.

Table 2. − The difference of the produced and the reference values.

	/I/		/e/		/æ/		/ʌ/		/ɒ/		/ʊ/		/ə/		Mean
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	
E^1_A	45	316	210	244	169	183	172	144	134	189	49	133	118	370	**176.9**
E^2_A	49	248	101	161	97	126	108	193	105	150	61	149	73	141	**125.8**
K^1_A	37	289	224	223	86	173	139	156	127	165	40	98	98	387	**160.2**
K^2_A	40	363	161	190	67	153	90	208	106	150	45	157	68	188	**141.9**

4. Discussion

20 The experiment attempted to synthesize a theoretical analysis as well as to establish causal relationships of the explored parameters, using an intentional manipulation of the dependent variable along with the analysis of variable causal relationships. We used a covariance analysis in the experimental plan to measure the dependent variable before and after the experimental intervention. Under the conditions of the current experiment, a complete randomization of participants was not possible, so we applied the principle of availability. The research design can thus be characterized as a quasi-experiment.

21 The validity of the measurement should be confirmed by the justified conclusions drawn on the basis of measurement. In order to ensure the internal measurement validity, we used the statistical operations of analysis of variance. We tried to strengthen the external measurement validity, i.e. the possibility of the generalization of results beyond the scope of this experiment, by experimenting in conditions reflecting natural communication. The content validity was derived from the prerequisite that the measurements of vocalic formants represent an overall level of participants pronunciation. The criterion validity was evaluated from the point of view of measurement agreement (experimental analysis) with a criterion variable—standard values of English vocalic formant values. The construct validity was verified with the given theoretical context and the prognostic validity was verified by formulating and verifying the hypotheses.

22 One of the primary aims of the research was to compare the effectiveness of contrastive and non-contrastive metaphonetic input in teaching English phonetics and phonology at a Slovak university. In adult learners, an analytical (cognitive) type of pronunciation

training is considered to be more effective than an imitative type of training (Chebenova, 2001). It follows that explicit awareness of the differences, similarities and potential possibilities of pronunciation mistakes (or deviations) resulting from the differences between the sound systems of the native and the foreign language would significantly contribute to improving the foreign language phonic performance of an individual.

23 Our study confirmed the higher effectiveness of contrastive meta-phonetic input, as reflected in the degree of vocalic approximation to the target formant values. The general rule of the psychology of learning—that by becoming aware, the resolution capacity of the analyser becomes significantly refined—has been confirmed.

24 The research results confirm both hypotheses:
1. English short vowels produced by the participants in the post-test will approximate to the referential values more than vowels produced in the pre-test.
   We can confirm this because the average approximation in both groups in the pre-test was 168.55 and in the post-test 133.85.
2. English short vowels produced by the experimental group in the post-test will approximate to the referential values more than vowels produced by the control group in the post-test.
   We can confirm this because the approximation in the experimental group in the post-test is 125.8 and in the control group in the post-test 141.9.

5. Conclusions

25 From the point of view of the percipient, the auditory impression of "good" or "bad" foreign language pronunciation is co-created by several subsegmental, segmental, plurisegmental and suprasegmental phonic phenomena (Kralova, 2016). Some studies (e.g. Kralova, 2011) have shown that the amount of segmental sound substitutions significantly correlates with the evaluation of speech as non-native. However, this does not mean that substitutions are the only criterion. They are likely the easiest to be identified by the ear, and the listener constructs an overall impression of foreign language speech combining several factors.

26 The current study provides several departure points for possible future research. It would be possible to carry out a similar analysis of suprasegmental level phenomena, or to explore the influence of segmental training of English pronunciation to an overall English phonic competence in comparison with a suprasegmentally focused training. Future work could also attempt to establish the retention rate of the phenomena after training, as well as other lingual or extra-lingual determinants of foreign language pronunciation.

27 Foreign language pronunciation is a complex and complicated phenomenon. It is not always possible to atomize elements and study foreign language pronunciation as a whole. Nevertheless, the difficulties and complexities involved should not prevent researchers from seeking appropriate generalizations, in the pursuit of findings which are applicable to a variety of contexts of teaching and learning foreign language pronunciation.

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ABSTRACTS

Almost every study on explicit meta-phonetic instruction in teaching foreign language (L2) pronunciation confirms its facilitating effect. However, hardly any studies applying contrastive (L1-L2) meta-phonetic instruction are available so far. The current study examines the effectiveness of contrastive meta-phonetic input in comparison with the effectiveness of non-contrastive (L2) meta-phonetic input via the laboratory analysis of 80 adult Slovak speakers' English pronunciation. Their English pronunciation quality, as reflected in the formant structure of vowels is measured before and after the contrastive input in the experimental group and non-contrastive input in the control group. The values are then compared to the standard values of British English vowels. It is hypothesized that English vowels produced by the experimental group approximate to the standard values more than the vowels produced by the control group. The results showed a more significant approximation in the experimental group which indicates higher effectiveness of contrastive meta-phontic input in teaching foreign language pronunciation.

Presque toutes les études sur l'enseignement métaphonétique explicite de la prononciation des langues étrangères (L2) confirment son effet facilitateur. Cependant, jusqu'à présent, il n'existe pratiquement aucune étude sur l'enseignement métaphonétique contrastif (L1-L2). La présente étude examine l'efficacité de ce type d'enseignement par rapport à l'efficacité de l'enseignement

métaphonétique non contrastif (L2), en analysant expérimentalement la prononciation anglaise de 80 adultes slovaques. La qualité de leur prononciation anglaise, telle qu'elle se reflète dans la structure des voyelles, est mesurée avant et après l'input contrastif dans le groupe expérimental et l'input non contrastif dans le groupe contrôle. Les valeurs sont ensuite comparées aux valeurs standard des voyelles de l'anglais britannique. On fait l'hypothèse que les voyelles anglaises produites par le groupe expérimental se rapprochent davantage des valeurs standard que les voyelles produites par le groupe contrôle. Les résultats montrent une approximation plus juste dans le groupe expérimental, ce qui indique une plus grande efficacité de l'entrée métaphonétique contrastive dans l'enseignement de la prononciation des langues étrangères.

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